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DIVISION 04 - MASONRY

SECTION 04200

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03/03

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SECTION 04200

MASONRY UNIT
03/03

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers facing brick, building (common) brick, block masonry, prefaced masonry units, glass block, coping tile, firebrick, flashing block, flue lining, structural clay wall tile, concrete brick, insulation and flashing built into masonry walls, reinforcing steel for masonry lintels, metal anchors and ties, normal and fire-rated masonry wall construction.

Drawings must indicate types of masonry, special shapes, patterns, bonding and coursing, location and required rating for fire walls, expansion and control joint details, glass block size, design type pattern and structural details, concealed insulation and flashing, pargeting, lintels, anchors and ties, and intersecting wall details.

Drawings must also indicate locations where different size or type facing brick are used in the same project.

Drawings must detail bond beams and must show placement of reinforcing steel.

Each project must be analyzed for differential movement of brick masonry, and provision made to relieve unit stress. Attention is directed to the BIA, technical notes on brick construction.

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

The publications listed below form a part of this section to the extent referenced:

ACI INTERNATIONAL (ACI)

ACI 306R	(1988) Cold Weather Concreting
ACI 530.1	(2002) Specification for Masonry Structures

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE-02	(1999) Handbook, HVAC Applications (IP Edition)
ASHRAE-05	(1999) Handbook, HVAC Applications (SI Edition)

ASTM INTERNATIONAL (ASTM)

ASTM A 116	(2000) Standard Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
ASTM A 153/A 153M	(2001a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	(1999) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 575	(2002) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 615/A 615M	(2001b) Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 641	(1998) Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire
ASTM A 641M	(1991) Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire (Metric)

ASTM A 82	(2001) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM B 224	(1998) Standard Classification of Coppers
ASTM B 370	(1998) Standard Specifications for Copper Sheet and Strip for Building Construction
ASTM C 1019	(2000b ^{el}) Standard Test Method for Sampling and Testing Grout
ASTM C 140	(2002) Standard Methods of Sampling and Testing Concrete Masonry Units
ASTM C 150	(2002) Standard Specification for Portland Cement
ASTM C 155	(1997) Standard Classification of Insulating Fire Brick
ASTM C 216	(2001a) Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	(2001a) Standard Specification for Mortar for Unit Masonry
ASTM C 33	(2002) Standard Specification for Concrete Aggregates
ASTM C 331	(2001) Standard Specification for Lightweight Aggregates for Concrete Masonry Units
ASTM C 34	(1996) Standard Specification for Structural Clay Load-Bearing Wall Tile
ASTM C 387	(2000e ^{el}) Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete
ASTM C 426	(1999) Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units
ASTM C 476	(2001) Standard Specification for Grout for Masonry
ASTM C 516	(1980; R 1996e ^{el}) Standard Specification for Vermiculite Loose Fill Thermal Insulation
ASTM C 518	(1998) Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means

	of the Heat Flow Meter Apparatus
ASTM C 549	(1981; R 1995e1) Standard Specification for Perlite Loose Fill Insulation
ASTM C 55	(2001a) Standard Specification for Concrete Building Brick
ASTM C 56	(1996) Standard Specification for Structural Clay Non-Load-Bearing Tile
ASTM C 568	(1999) Standard Specification for Limestone Dimension Stone
ASTM C 595	(2002) Standard Specification for Blended Hydraulic Cements
ASTM C 618	(2001) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 62	(2001) Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale)
ASTM C 641	(1998e1) Standard Test Method for Staining Materials in Lightweight Concrete Aggregates
ASTM C 67	(2002a) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C 744	(1999) Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 861	(1993) Standard Practice for Determining Metric Dimensions of Standard Series Refractory Bricks and Shapes
ASTM C 90	(2002) Standard Specification for Load-Bearing Concrete Masonry Units
ASTM C 91	(2001) Standard Specification for Masonry Cement
ASTM C 989	(1999) Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 1056	(2000) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1752	(1984; R 1996e1) Standard Specification

for Preformed Sponge Rubber and Cork
Expansion Joint Fillers for Concrete
Paving and Structural Construction

ASTM D 2000 (2001) Standard Classification System for
Rubber Products in Automotive Applications

ASTM D 226 (1997a) Standard Specification for
Asphalt-Saturated Organic Felt Used in
Roofing and Waterproofing

ASTM D 227 (1997a) Standard Specification for
Coal-Tar-Saturated Organic Felt Used in
Roofing and Waterproofing

ASTM E 119 (2000a) Standard Test Methods for Fire
Tests of Building Construction and
Materials

ASTM E 84 (2001) Standard Test Method for Surface
Burning Characteristics of Building
Materials

BRICK INDUSTRY ASSOCIATION (BIA)

BIA Tech Note 20 (1990) Cleaning Brick Masonry

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2000) International Building Code

ICC IPC (2000) International Plumbing Code

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
(SMACNA)

SMACNA ASMM (1993) Architectural Sheet Metal Manual

UNDERWRITERS LABORATORIES (UL)

UL 723 (1996; 7th Ed) UL Standard for Safety Test
for Surface Burning Characteristics of
Building Materials

1.2 MASONRY-WALL PANEL

NOTE: This paragraph may be deleted for small
buildings (5,000 square feet 465 square meter or
less) and where appearance is not of major
importance.

Before starting installation of masonry work, the Contractor shall erect a

sample masonry wall in an approved location for approval.

Exterior brick faced walls shall be open-cavity construction.

Sample wall shall be 4 feet 1200 millimeter high by 8 feet 1800 millimeter long, with a corner return of 2 feet 600 millimeter. Wall shall consist of an exterior wythe of face bricks and an interior wythe of masonry units representative of the type required. Facing brick shall be from the same production run as the brick to be used for construction. Wall shall be constructed with anchors or ties, insulation, concealed flashing, weep slots, and cavity typical of the construction.

Sample wall shall show the full color range, texture, type of bond, joint treatment. Wall shall be pointed and cleaned.

Sample wall panel shall be approved before commencing work. Unsatisfactory sample walls shall be removed and additional sample walls erected until approval is obtained. Approved sample wall shall remain and shall be properly protected until completion and acceptance of the work.

Approved sample wall panel shall be the standard of quality for workmanship and materials. Masonry work shall be at least equal in quality to that of the sample wall panel.

Brick Sample Panels provided for facing brick shall be 4 feet 1200 millimeter high by 8 feet 1800 millimeter long, and shall show the size, texture, and complete range of colors.

Block Sample Panels provided shall be 4 feet 1200 millimeter high by 8 feet 1800 millimeter long, and shall show complete range of size, texture, and color.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01330, "Submittal Procedures," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Erection Drawings for the following items shall be furnished in accordance with the paragraph entitled, "Quality Control During Construction," of this section.

Reinforcing Steel in Lintels
Reinforcing Steel in Beams
Reinforcing Steel in Piers
Reinforcing Steel in Walls
Unit Sizes and Wall Patterns
Anchoring Methods

SD-03 Product Data

Manufacture's Product Data shall be submitted for the following:

Special Block
Special Brick Shapes
Glass Block
Anchor Devices
Special Masonry Shapes
Caging Devices and Centering Clips
Detergent Cleaning Compounds
Flashing Blocks

SD-04 Samples

Submit the following samples in sufficient numbers to show full range in color, texture, shapes and sizes (minimum of three each).

Facing [Brick]
[Clay]
[Shale Brick]
Sand-Lime Brick
Block Masonry
Concrete Brick
Split Block
Structural Clay Wall Tile
Limestone

Joint Reinforcement - one piece of each type of reinforcement 18 inches 450 millimeter long, showing at least two cross joints.

[Stone] [Terra Cotta] - one piece 6 by 8 inches 150 by 200 millimeter in size, showing color, finish, and texture.

Brick Sample Panels shall be constructed according to the paragraph entitled, "Masonry-Wall Panel," of this section.

Block Sample Panels shall be constructed according to the paragraph entitled, "Masonry-Wall Panel," of this section.

Anchors and Ties - one of each type.

SD-06 Test Reports

Test reports shall be furnished for the following items in accordance with the paragraph entitled, "Sampling and Testing," of

this section.

Brick Materials
Block Masonry Units
Prefaced Block Masonry Units
Mortar
Grout

SD-07 Certificates

Certificates shall be furnished stating that Brick Materials furnished have been produced from sources known from experience to be nonexpansive. Brick materials shall conform to applicable reference standards contained within this section.

SD-08 Manufacturer's Instructions

Manufacturer's Instructions shall be submitted for the following in accordance with paragraph entitled, "Protection of Materials and Work," of this section.

Special Block
Special Brick Shapes
Glass Block
Anchor Devices
Detergent Cleaning Compounds

1.4 SAMPLING AND TESTING

**NOTE: Delete paragraph heading and the following
four paragraph headings and paragraphs when job
control eliminates the necessity of testing.**

1.4.1 Testing Services

Laboratory testing and inspection service shall be provided as part of the work. Testing services shall be approved and shall include quality control sampling and testing of block masonry, grout and mortar during construction.

1.4.2 Quality Control During Construction

Erection Drawings for Reinforcing Steel in Lintels, Reinforcing Steel in Beams, Reinforcing Steel in Piers, Reinforcing Steel in Walls, Special Block, Special Brick, Special Masonry Shapes, Unit Sizes and Wall Patterns and Anchoring Methods shall be furnished meeting all design specifications as required by referenced standards within this section. Methods of anchoring masonry work to other trades shall be shown.

Brick Materials, Block Masonry Units, Prefaced Block Masonry Units and Mortar shall be sampled and tested for quality control during construction as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST</u>	<u>NUMBER/TESTS</u>
Brick materials	Material, workmanship, finish, texture, color range, and size	ASTM C 216 and ASTM C 67	One test each 10,000 bricks or fraction thereof
	Efflorescence	ASTM C 67	One test each 10,000 bricks or fraction thereof
	Compressive strength	ASTM C 67	One test each 10,000 bricks or fraction thereof
Block masonry units and prefaced block masonry units	Visual inspection	ASTM C 90	3 units each shipment
	Dimensional variation	As specified*	3 units each shipment
	Face shell and web thickness	ASTM C 90	3 units each shipment
	Compressive strength	ASTM C 140	One test each 10,000 blocks or fraction thereof
	Absorption	ASTM C 140	One test each 10,000 blocks or fraction thereof

NOTE: When total number of block masonry units exceeds 50,000 units, include the following tests for block masonry units.

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST</u>	<u>NUMBER/TESTS</u>
	Drying shrinkage	ASTM C 426	One set per project. Additional test when material or source changes
Mortar	Air entrainment	ASTM C 91	One test set for each 10,000 bricks or each 3,000 block masonry units

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST</u>	<u>NUMBER/TESTS</u>
	Compressive strength	ASTM C 91	
	Water retention	ASTM C 91	
Grout	Compressive strength	ASTM C 1019	

*Specified under paragraph entitled, "Quality."

1.4.3 Quality Control Reports

Testing service shall report test results in writing.

1.4.4 Evaluation of Test Results

Materials that do not conform to specifications shall be removed from the site.

When the tests indicate nonconformance, additional tests of units in the shipment shall be made. When 10 percent or more of the additional units tested also indicate nonconformance, the shipment will be rejected.

1.5 DELIVERY AND STORAGE

Masonry units shall be delivered, carefully stacked on pallets to avoid chipping, and stored to prevent soiling. Masonry units shall be kept dry until placed by storing in a weathertight structure or, when stored in the open, shall be covered with approved moisture-resistant covers, completely enclosing the material.

5 shall be packed in substantial containers or banded on pallets for delivery and storage.

Cement materials shall be furnished in bags displaying the manufacturer's trademark and type. Material shall be dry and free of lumps when delivered. Upon delivery, material shall be stored in dry, weathertight, properly ventilated structures. Different brands or types of mortar shall be stored separately and shall not be intermixed.

Aggregates shall be stored and handled in such manner as to prevent intermixing with foreign matter.

Masonry reinforcement shall be protected from contact with the soil. Anchors and ties shall be stored in containers in a weathertight structure.

1.6 PROTECTION OF MATERIALS AND WORK

Contractor shall protect materials from damage when stored and during construction.

Top of masonry walls shall be kept dry by covering when work is not in progress. Covers shall be lapped at least 6 inches 150 millimeter at joints and shall overhang the top of the wall at least 2 feet 600 millimeter on each side. Exposed ends of walls shall be covered and the covers lapped at least 2 feet 600 millimeter on each side of the wall.

After erection, finished masonry walls shall be protected from damage due to subsequent building operations. Damaged facing units shall be removed and replaced.

Manufacturer's Instructions and Product Data for Special Block, Special Brick Shapes, Special Masonry Shapes, Glass Block, Anchor Devices and Detergent Cleaning Compounds shall be submitted for each type of item previously listed, including manufacturer's recommended methods for handling, installation and cleaning of the products when applicable.

PART 2 PRODUCTS

2.1 BRICK

2.1.1 Building Brick

Building brick shall conform to [ASTM C 62] [ASTM C 216] for the geographic region.

2.1.2 Facing Brick

NOTE: Drawings must detail locations where standard and norman size bricks are used in the same project. Drawings must detail special conditions and coursing if jumbo size brick is selected.

Specifier should select from type and grade options for each paragraph used. Insert Type FBS, FBX, or FBA and Grade MW or SW in the next six paragraphs.

Color range and face texture shall match approved samples and shall conform to ASTM C 216, Type [____], Grade [____].

Facing brick shall be Norman size, 11-5/8 by 2-1/4 by 3-3/4 inches 295 by 57 by 95 millimeter (11-5/8 by 2-1/4 by 3-3/4 inches), in color range and face texture matching approved samples, shall conform to ASTM C 216, Type [____], Grade [____].

Facing brick shall be a combination of standard size: 8 by 2-1/4 by 3-3/4 inches 203 by 57 by 95 millimeter (8 by 2-1/4 by 3-3/4 inches), and Norman size: 11-5/8 by 2-1/4 by 3-3/4 inches 295 by 57 by 95 millimeter (11-5/8 by 2-1/4 by 3-3/4 inches), each size in color range and texture matching approved samples, shall conform to ASTM C 216, Type [____], Grade [____].

Facing brick shall be jumbo size, 8 by 2-3/4 by 3-3/4 inches 203 by 70 by 95 millimeter (8 by 2-3/4 by 3-3/4 inches), in color range and face texture

matching approved sample, shall conform to ASTM C 216, Type [____], Grade [____].

Facing brick shall be modular size, 7-5/8 by 2-1/4 by 3-5/8 inches 194 by 57 by 92 millimeter (7-5/8 by 2-1/4 by 3-5/8 inches), in color range and face texture matching approved samples, shall conform to ASTM C 216, Type [____], Grade [____].

Facing brick shall match brick on existing building in size, color, range, face texture, and approved sample, and shall conform to ASTM C 216, Type [____], Grade [____].

The Contractor for this Section of the Work shall include in the Base Bid the cost for solid brick required, the cost for cutting of brick required, the cost for cutting of brick required to obtain special shapes, the cost of special size brick required, and the cost of special molded shapes required.

2.1.3 Common Brick

NOTE: Select one or more of the following grades of common brick, based on conditions of use in the project. Do not select this brick if a particular color, texture, finish, uniformity or freedom from cracks or other flaws is required.

[Building brick shall be standard size: 8 by 2-1/4 by 3-3/4 inches 203 by 57 by 95 millimeter (8 by 2-1/4 by 3-3/4 inches), matching approved samples, and shall conform to ASTM C 62, Grade SW.]

[Building brick shall be modular size: 7-5/8 by 2-1/4 by 3-5/8 inches 194 by 57 by 92 millimeter (7-5/8 by 2-1/4 by 3-5/8 inches), matching approved samples, and shall conform to ASTM C 62, Grade SW.]

2.1.4 Firebrick

Firebrick shall conform to ASTM C 62, ASTM C 861 and ASTM C 155, Low-Duty.

2.1.5 Concrete Brick and Split Block

Concrete brick and split block shall conform to ASTM C 55, Type I, Moisture-Controlled Units, and may, at the option of the Contractor, be used in lieu of common Clay or Shale Brick. Concrete brick and split block shall not be used for exterior facing unless such facing is indicated as concrete brick or split block. Grade N units, Sand-Lime Brick, shall be used for exterior facing and for work below grade. Grade [N-I] [S-I] units shall be used for masonry backup. Units shall be delivered to the job site in an air-dry condition, shall conform to grade and physical requirements, and shall be classified into group 1 and group 2, depending upon the linear-shrinkage potential as follows:

		MAXIMUM LINEAR SHRINKAGE, PERCENT (ASTM C 426)	
<u>GRADE</u>	<u>CONCRETE DENSITY POUND PER CU FT</u>	<u>GROUP 1</u>	<u>GROUP 2</u>
N-I	120 or more	0.065	0.03
	less than 120	0.065	0.04
S-I	120 or more	0.065	0.04

		MAXIMUM LINEAR SHRINKAGE, PERCENT (ASTM C 426)	
<u>GRADE</u>	<u>CONCRETE DENSITY KILOGRAM PER CUBIC METRE</u>	<u>GROUP 1</u>	<u>GROUP 2</u>
N-I	1922 or more	0.065	0.03
	less than 1922	0.065	0.04
S-I	1922 or more	0.065	0.04

2.2 CONCRETE MASONRY UNITS

2.2.1 Unit Types

Units shall be [normal] [lightweight] concrete, load-bearing, [hollow] [solid] and shall conform to ASTM C 90, Type [I] [II] for hollow units and solid units.

2.2.2 Grade

[Cement used in concrete blocks, bricks, and lintels shall be blended hydraulic cement conforming to ASTM C 595, Type [____].]

[Units shall be Grade [N-1] [S-1], manufactured from aggregates conforming to ASTM C 33.]

[Units for use in walls below grade shall be Grade N-1, manufactured from normal weight aggregates conforming to ASTM C 33. Units for use above grade shall be Grade N-1, manufactured from aggregates conforming to ASTM C 331 or normal-weight aggregates conforming to ASTM C 33. Units for use above grade in exterior walls with a weather-protective coating and walls not exposed to the weather may be Grade S-1; manufactured from aggregates conforming to ASTM C 331 or normal weight aggregates conforming to ASTM C 33.]

[Units used in the work shall be Grade N-1, manufactured from aggregates conforming to ASTM C 331.]

Units used in fire-rated wall assemblies shall have applicable UL classification.

[Aggregate used in making masonry units, concrete brick, and split block shall conform to [ASTM C 33] [ASTM C 331]. Grading of aggregates as stipulated in ASTM C 331, and testing of lightweight aggregates for drying shrinkage as stipulated in ASTM C 331, will not be required.]

NOTE: Ground granulated blast furnace slag and fly ash is one of the materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg/>). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/ performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (<http://nodis3.gsfc.nasa.gov>).

[For concrete blocks, bricks, and lintels, ground granulated blast furnace slag [is required] [used] as an admixture [and] shall conform to ASTM C 989, Grade [120] with between 25 to 50 percent maximum cement replacement by weight.]

[For concrete blocks, bricks, and lintels, fly ash [is required] [used] as an admixture [and] shall conform to ASTM C 618, Class [C or F] with 4 percent maximum loss on ignition and between 15 to 35 percent maximum cement by replacement weight.]

2.2.3 Quality

Units shall be modular in size and shall include special shapes as required for corners, sash, control joints, jambs, heads, lintels, headers, and bonding block.

Net overall dimensions: Width, height, or length shall differ by not more than 1/8 inch 3.2 millimeter from the specified standard dimensions. Units shall be uniform as to dimension, with arrises and exposed vertical edges free from warp. Face surface shall be planar, with no variations greater than 1/32 inch 1.0 millimeter.

Units shall have a face shell thickness conforming to ASTM C 90, and shall be sufficient to adequately embed masonry reinforcement.

Units exposed to view shall be selected for smoothness and uniformity in appearance and texture and shall be free of imperfections, spalls and chips larger than 1/2 inch 13 millimeter, chipped corners, cracks, or defects.

External corners and window and door openings (except at heads) throughout habitable spaces shall have 1-inch 25 millimeter radius bullnose corners.

Lightweight aggregates used in the manufacture of masonry units shall not exceed "light stain" classification when tested by the visual classification method of ASTM C 641. Units shall be free of deleterious materials that stain plaster, bleed through paint, or corrode metal.

When determined by the chemical-analysis method, the iron stain deposited on the filter paper from a 200-gram sample shall not exceed 1.5 milligrams of ferric oxide.

2.3 PRECAST LINTEL UNITS

Units intended for use over openings in walls of masonry units shall be cast with the same type cement and aggregate used for the masonry units.

Units shall be cast of concrete having a 28-day compressive strength of not less than 3,000 pounds per square inch (psi) 21 Megapascal. Cast-on-site lintels shall not be permitted.

Lintels shall be of length sufficient to bear 8 inches 200 millimeter (minimum) on each side of opening.

2.4 PREFACED BLOCK MASONRY UNITS

Prefaced block masonry units shall be lightweight structural block masonry units conforming to ASTM C 90, Grade N-1. Facing material shall conform to ASTM C 744.

2.5 COPING TILE

Tile shall be salt-glazed fire-clay, Terra-Cotta, or precast block units with socket joints. Units shall be sound, free from fractures, cracks, blisters, and warping and shall be the standard size and proper width to overlap the wall masonry. Shapes required for external and internal angles shall be furnished.

2.6 LIMESTONE COPING, SILLS

Limestone shall be in accordance with ASTM C 568. [Limestone shall match existing limestone trim in quality, color, texture and finish.]

Limestone shall be oolitic limestone, Category II, medium density, buff color, select grade, with smooth finish, in accordance with ASTM C 568.

Stone shall be cut to shape and dimensions indicated, with exposed faces dressed true, beds and joints at right angles to face.

Anchors, dowels and fasteners for stone shall be fabricated of stainless steel.

2.7 FLASHING BLOCKS

Blocks shall be hard-burned with a diagonal groove not less than 1-1/2 inches 38 millimeter deep measured horizontally to receive the flashing. Shapes shall provide a continuous groove around corners and for offsets. Blocks shall be of a size to replace and course with two courses of brick.

2.8 FLUE LINING AND THIMBLES

Flue lining and thimbles shall be hard-burned fire clay or shale, shall be free from blisters and warping, and shall be of standard sizes and sound manufacture. Flue linings of other materials and manufacturing processes shall be [UL approved] [as approved].

2.9 STRUCTURAL CLAY WALL TILE

Structural clay wall tile of the sizes and shapes required may be used in lieu of concrete masonry units. Exposed faces of the tile shall be smooth finished except where the tile serves as a base for stucco or plaster or as setting beds for wall tile. In such locations, the tile shall have a plaster-base finish. Smooth-faced structural clay wall tile shall be free from glaze, popouts, lime pits, and other disfiguring blemishes detracting from the appearance of the finished wall when viewed from a distance of 20 feet 6 meter. Structural clay wall tile used in any one building shall be of the same composition, size, and appearance. In single-wythe two-faced walls, or in partition walls, where such walls are in habitable rooms or spaces and are either to be painted or exposed to view, the tile shall not exceed 1-1/2-percent difference in extreme dimensions. Tile shall include closers, jamb, and other required shapes, and shall conform to the following:

2.9.1 Load-Bearing Tile

Load-bearing clay wall tile shall be either vertical-cell or horizontal-cell type. Vertical-cell type clay wall tile shall conform to ASTM C 34. Horizontal-cell clay wall tiles with the outer shell and adjacent vertical web not more than 1-1/4-inches 32 millimeter apart, shall conform to ASTM C 34. Units may be either Grade LBX or LB, at the option of the Contractor, except that only Grade LBX units shall be used in uncoated and unpainted exterior walls.

2.9.2 Non-Load-Bearing Tile

Non-load-bearing clay wall tile conforming to ASTM C 56 shall be used in lieu of non-load-bearing concrete masonry units.

2.9.3 Fire-Resistant Tile

Fire-resistant clay wall tile shall be of the type that will give the fire rating required when subjected to the standard fire tests of ASTM E 119. A certified statement by a recognized testing laboratory indicating that the tiles are capable of meeting the stipulated requirements shall be furnished with each shipment of tile.

2.10 GLASS BLOCK

Glass block shall be partially evacuated hollow units of clear, colorless glass, formed of two halves fused together at high temperature, of the size, design, and pattern indicated.

Glass block shall be packed in manufacturer's standard paper cartons or trays. Units shall not be removed from the cartons until they are to be placed in the work.

Accessories for use with glass block including panel anchors, expansion strips, panel reinforcing, wire, asphalt emulsion, and oakum shall be provided by the glass block manufacturer in the quantity, size, and thickness required.

Panel anchors shall be 20-gage 1.0 millimeter perforated steel, 1-3/4 inches 43 millimeter wide, hot-dip galvanized after fabrication.

Panel reinforcing shall be galvanized steel, double wire mesh, formed of two parallel 9-gage 3.9 millimeter wires 2 inches 50 millimeter on center, with welded 14-gage 2.0 millimeter cross wires at 8 inches 200 millimeter on center.

2.11 MORTAR

2.11.1 Mortar Materials

Mortar materials and proportions shall conform to ASTM C 270, with the following amendments:

[Portland cement shall conform to ASTM C 150, Type [____].]

[Blended hydraulic cement shall conform to ASTM C 595, Type [____].]

One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.

2.11.2 Types of Mortar

Type [M] [S] mortar, as defined in Table 2 of ASTM C 270, shall be used.

2.11.3 Premixed Packaged Color Mortar

Mortar for facing brick and limestone joints shall be custom colored, premixed, packaged, dry, combined materials conforming to ASTM C 91. Mortar color shall match existing mortar color. Pigments shall be non-reactive, and color fast to sunlight, alkalies and weak acids.

2.11.4 Packaged Materials for Mortar and Concrete

Packaged, dry, combined materials for mortar and concrete shall conform to ASTM C 387, with the following amendments:

[Portland cement shall conform to ASTM C 150, Type [____].]

[Blended hydraulic cement shall conform to ASTM C 595, Type [____].]

One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.

Maximum size of coarse aggregate shall not exceed 3/4 inch 19 millimeter.

Mortar shall be limited to Type [M] [S], ASTM C 270.

2.11.5 Admixtures for Mortar

Calcium chloride admixtures, antifreeze liquids, and salts shall not be used.

2.12 GROUT

NOTE: Ground granulated blast furnace slag and fly ash is one of the materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg/>). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/ performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (<http://nodis3.gsfc.nasa.gov>).

Grout shall conform to [ASTM C 476] or [ACI 530.1]. Compressive strength at 28 days shall be [____] [2,000] pounds per square inch (psi) 13790 kilopascal minimum.

[Grouts produced with blends of portland cement and ground granulated blast furnace slag shall have the minimum compressive strength specified by ASTM C 476.]

2.13 MASONRY ANCHORS AND TIES

2.13.1 Zinc Coating

Zinc coating of anchors and ties shall conform to ASTM A 153/A 153M, Class [B-1] [B-2] [B-3] as required. Zinc coating of wire for joint reinforcing shall conform to ASTM A 116, Class 1.

2.13.2 Dovetail Slots, Anchors, and Ties

Dovetail slots shall be 20-gage 1.0 millimeter galvanized steel, 1-inch 25 millimeter wide by 5/8-inch 16 millimeter face by 1-inch 25 millimeter deep.

Dovetail anchors shall be 14-gage 2.0 millimeter galvanized steel crimped brick anchors, 1-inch 25 millimeter wide by length as required for masonry unit, turned up 1/4 inch 6 millimeter at outer end.

Dovetail brick ties for cavity walls with 2-inch 50 millimeter air space between brick facing and concrete shall be 9-gage 3.9 millimeter hot-dip-galvanized steel wire ring.

Dovetail-type anchors for use with embedded slots or inserts shall be sheet steel not lighter than 0.0598-inch (16-gage) 1.6 millimeter thick, 1-inch 25 millimeter wide, flat anchors for block masonry units and structural-clay-tile facing, and steel wire not lighter than 0.1483-inch (9-gage) 3.9 millimeter diameter for brick and split-block facing.

2.13.3 Individual and Adjustable Wall Ties

Individual wall ties shall be [galvanized steel 7/8-inch 22 millimeter wide by 7-inches 175 millimeter long by No. 22 gage 0.85 millimeter (No. 22 gage)] [looped galvanized wire 3/16-inch 5 millimeter diameter by 7-inches 175 millimeterlong].

Individual cavity wall ties shall be galvanized steel rods, 1/4-inch 6 millimeter diameter, 8-inches 200 millimeter long, Z-bar.

Individual cavity wall ties and adjustable wall ties shall be galvanized steel rods, 1/4-inch 6 millimeter diameter, in [triangular] [rectangular] [straight] shape.

Adjustable wall ties shall be rectangular type, 3/16-inch 5 millimeter diameter high-tensile cold-drawn galvanized-steel wire conforming to ASTM A 82.

2.13.4 Column Anchors, Beam Anchors, and Ties

Column anchors shall be steel bars, formed of merchant quality hot-rolled carbon steel conforming to ASTM A 575, 1/4 by 3/4 inch, 6 by 19 millimeter, shop painted, length as required by wall thickness.

Column anchors shall be galvanized steel rods, 1/4-inch 6 millimeter in diameter, in [triangular] [rectangular] shape.

Beam anchors shall be steel bar shapes, formed from carbon steel conforming to ASTM A 575, 3/16 by 1 inch, 5 by 25 millimeter, shop painted, length as required by wall thickness.

Column clips for ties between masonry fireproofing and steel columns shall be 10-gage 3.5 millimeter galvanized steel wire clips. Clips shall be installed 24 inches 600 millimeter on center.

Flexible ties for tying masonry to structural steel shall be galvanized

steel straps, 1/2 by 1/8 inch by 9-inches 13 by 3 by 225 millimeter long, tack-welded to steel 16 inches 400 millimeter on center, with 3/16-inch 5 millimeter mill-galvanized wire ties, rectangular or triangular design, size as required by wall thickness.

2.13.5 Partition Anchors

Masonry partition anchors shall be Z-bars formed from carbon steel conforming to ASTM A 575, 1-1/2 by 1/4 by 28-inches 38 by 6 by 711 millimeter long, hot-dip galvanized.

2.13.6 Reinforcing Steel

Reinforcing bars shall be deformed billet steel bars conforming to ASTM A 615/A 615M, Grade [40] [50] [60].

2.13.6.1 Fabrication

ACI 530.1

2.13.6.2 Caging Devices and Centering Clips

In hollow concrete masonry cores or brick cavities to be reinforced with vertical reinforcing steel bars and filled with grout, provide 9 gauge galvanized steel caging devices.

2.14 WALL REINFORCEMENT

2.14.1 Joint Reinforcement

Joint reinforcement shall be cold-drawn steel wire conforming to ASTM A 82. Deformations shall be in accordance with ASTM A 615/A 615M. Wire shall have a tensile strength of 80,000 psi 550 Megapascal. Side rods shall be deformed steel wire. Cross ties or truss members may be plain or deformed steel wire.

Joint reinforcement shall be ladder or truss design, with side rods and cross ties flush-welded in a single plane.

Truss design reinforcement shall not be used in cavity wall construction.

Joint reinforcement shall be galvanized after fabrication with 1.0-ounce per square foot 0.24 kilogram per square meter zinc coating in accordance with ASTM A 641 ASTM A 641M, Class 3.

Joint reinforcement for corners and intersecting walls shall be fabricated as corner and T-shapes and shall be the same gage thickness in millimeter and finish wire.

Outside width of side rods shall be approximately 2 inches 50 millimeter less than the nominal width of the wall. Cross ties or rods shall be spaced not more than 16 inches 400 millimeter on center.

Joint reinforcement shall be furnished in flat sections in maximum

practical length. Reinforcement furnished in rolls shall not be permitted.

Joint reinforcement for cavity walls may be of two-part construction, with ladder and eye section, and with pintle section.

2.14.2 Gage of Joint Reinforcement

Cross ties or cross rods shall be 9-gage 3.9 millimeter, spaced not more than 16 inches 400 millimeter on center, either plain or deformed steel wire.

[Side rods shall be 9-gage 3.9 millimeter.]

[Side rods shall be 3/16-inch 5 millimeter diameter.]

2.15 CONTROL-JOINT MATERIAL

NOTE: Delete control joint materials not required for project.

In addition to joints spaced as required by wall thickness, height, and building design, additional control joints must be placed at points of stress concentration such as changes in wall height or thickness, at intersection of structural steel or concrete members, at pipe or equipment chases, and at building offsets, junctions, and corners.

2.15.1 Flexible-Joint Filler Strip

Flexible-joint filler strips for use in control joints formed with sash blocks or built-in between block masonry and concrete or brick shall be molded from natural or synthetic rubbers conforming to ASTM D 2000, Grade 4AA730B13A114, and neoprene conforming to ASTM D 1056, Grade SCE 42. Strips shall be T-shaped, approximately 2-5/16-inches 67 millimeter long by 1-7/16-inches 37 millimeter wide, with 11/16-inch 17 millimeter flanges. Strips shall have factory-applied adhesive on one face.

2.15.2 Bond Breaker Strips

Bond breaker strips for use in end webs of concrete masonry units at indicated control joints shall be [15-pound per 100 square foot 7.5 kilogram per 10 square meter asphalt roofing felt, conforming to ASTM D 226] [15-pound per 100 square foot 7.5 kilogram per 10 square meter coal tar roofing felt, conforming to ASTM D 227].

2.15.3 Steel and Masonry Isolation Liners

Isolation liners for use between masonry and structural steel frame shall be treated asphalt-impregnated cellular paper, 1/4 inch 6 millimeter (single thickness) and 1/2 inch 13 millimeter (double thickness). Material shall be applied in double thickness, except where wall dimensions do not

permit.

2.15.4 Expansion-Joint Material

Material shall be preformed, nonextruding and nonbituminous, sponge-rubber joint filler, thickness as indicated, conforming to ASTM D 1752, Type I.

2.15.5 Joint Fillers and Sealants

Externally applied joint fillers, back-up materials for sealants, and joint sealants are specified in the Section 07920, "Sealants and Calkings."

Expansion joint fillers, metal expansion strip isolation liners, and bond breakers shall be built-in as the masonry wall is laid up.

2.16 FLASHING

2.16.1 Materials

[Sheet-metal flashing shall be standard electrolytic tough-pitch copper, Type ETP or fire-refined tough-pitch copper, Type FRTP, as classified in ASTM B 224 and conforming to ASTM B 370, cold-rolled temper.]

[Sheet-metal flashing shall be 0.015-inch 0.38 millimeter thick, corrosion-resisting chromium-nickel steel conforming to ASTM A 167, Type [301] [302] [304] [316], No. 2D finish, annealed temper, as required for end use.]

[Sheet-metal flashing shall be 6-ounce 170 gram copper conforming to ASTM B 370, cold rolled and soft temper, or corrosion-resistant steel conforming to ASTM A 167, Type [301] [302] [304] [316], No. 2D finish, annealed temper, as required for end use.]

[Copper-fabric flashing shall be 5-ounce 142 gram electrolytic sheet copper conforming to ASTM B 370, soft temper, bonded on both sides to asphalt-saturated cotton fabric with a ductile asphalt mastic, with the laminate assembly corrugated the full width of the sheet.]

[Copper-reinforced kraft paper flashing shall be 3-ounce 85 gram electrolytic sheet copper conforming to ASTM B 370, soft temper, bonded on both sides by asphalt to sisal-fiber-reinforced heavy asphalt-saturated crepe kraft paper.]

[Copper-coated flashing shall be electrolytic sheet copper conforming to ASTM B 370, soft temper, uniformly coated on both sides with an acid-and alkali-resistant bituminous compound. Compound shall be factory-applied to a weight of not less than 6 ounces per square foot 1.8 kilogram per square meter on each side.]

2.16.2 Location

[Through-wall flashing of masonry walls with a cavity over 3/4-inch 19 millimeter wide between inner and outer wythes, and the head and sill flashing of masonry wall openings with a cavity over 3/4-inch 19 millimeter

wide, shall consist of [10-ounce 283 gramsheet-copper] [0.015-inch 0.38 millimeter thick corrosion-resistant steel] flashing.]

[Through-wall flashing of masonry walls with a cavity not more than 3/4-inch 19 millimeter wide between inner and outer wythes, and the head and sill flashing of masonry wall openings with a cavity between wythes of not more than 3/4-inch, 19 millimeter, shall consist of [5-ounce copper-fabric flashing or 10-ounce 283 gram copper flashing or 0.015-inch 0.38 millimeter thick corrosion-resistant steel flashing.] [copper-fabric flashing or copper-reinforced kraft paper flashing. Weight of sheet copper shall be not less than 3 ounces 85 gram.]]

[Spandrel flashing shall be [3] [5]-ounce [85] [142] gramcopper-coated flashing or [3] [5]-ounce [85] [142] gramcopper-reinforced kraft paper flashing.]

Building expansion-joint flashing shall be [16-ounce 453 gramcopper] [0.015-inch 0.38 millimeter corrosion-resistant steel] formed in a bellows or U-flange profile.

Termite barriers shall be [16-ounce 453 gram copper] [0.015-inch 0.38 millimeter corrosion-resistant steel] flashing.

Through-wall flashing below copings shall be [16-ounce 453 gramcopper] [0.015-inch 0.38 millimeter corrosion-resistant steel]. Flashings shall be crimped, ribbed, or corrugated to provide an integral mortar key and shall be formed to preclude pockets of water.

2.16.3 Flashing Mastic

Mastic for lap joints of corrosion-resistant steel flashings shall be a non-skinning, non-sagging, flexible butyl sealant.

2.17 INSULATION MATERIALS

NOTE: When insulation materials are not specified
in an accompanying Division 7 section, edit the
following paragraphs accordingly.

2.17.1 Loose-Fill Insulation

Loose-fill insulation shall be [vermiculite conforming to the requirements of ASTM C 516, Grade 3] [perlite conforming to the requirements of ASTM C 549].

2.17.2 Board Insulation

NOTE: The following btu/hour number is arbitrary
and must be changed to suit project requirements.

Board insulation shall be rigid and not more than 1-1/2- to 2-inches 38 to 50 millimeter thick to provide a coefficient-of-heat transmission of U-value through the completed wall construction air-to-air not in excess of 0.18 Btu hour/square foot/degree F 1.02 watt per square meter per degree K (0.18 Btu hour/square foot/degree F) temperature difference when determined for winter conditions in accordance with recognized methods in agreement with ASHRAE-02 ASHRAE-05. Computations to determine insulation thickness shall be approved. Flame-spread rating shall not exceed 25 when tested in conformance with ASTM E 84.

2.17.3 Foam Insulation

Foam insulation shall be a two-part system consisting of resin and a foaming agent. Components, when combined in approved equipment, shall produce a low-density foam insulation.

NOTE: Foam insulation is one of the materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg/>). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/ performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (<http://nodis3.gsfc.nasa.gov>).

[Foam insulation shall contain a total recovered materials content of 5 percent.]

Typical Physical Properties:

<u>PROPERTY</u>	<u>TEST</u>	<u>RESULTS</u>
Thermal conductivity	ASTM C 518	K = 0.232 Btu per hour per foot per degree F
Thermal resistance	ASTM C 518	R = 4.30 degree F by square foot by hour per Btu
Surface burning characteristics	UL 723	

<u>PROPERTY</u>	<u>TEST</u>	<u>RESULTS</u>
	Flame spread	15
	Fuel contributed	0
	Smoke developed	5
<u>PROPERTY</u>	<u>TEST</u>	<u>RESULTS</u>
Thermal conductivity	ASTM C 518	K = 0.134 watt per hour per meter per degree K
Thermal resistance	ASTM C 518	R = 7.45 degree K by meter per watt by hour per Btu
Surface burning characteristics	UL 723	
	Flame spread	15
	Fuel contributed	0
	Smoke developed	5

PART 3 EXECUTION

3.1 ERECTION OF MASONRY WALLS

3.1.1 Masonry Work

Masonry work shall be laid out before installation to ensure proper location of openings, joints, building returns, and offsets. Dimensions shall be adjusted only when approved and when required by variations in the masonry unit dimensions.

Masonry work shall be plumb and true to line, with courses level and spaced to the vertical dimensions indicated. Except where stack bond is indicated, each course shall break joint with the course below. Bond pattern shall be kept plumb throughout.

Masonry walls shall be bonded in each course and bonded or anchored to connecting work with metal reinforcement ties. Masonry header ties shall be used only where indicated.

In unexposed masonry, deviations from running bond in vertical joints shall be less than 2 inches 50 millimeter.

Walls abutting or touching steel columns shall be anchored thereto with flexible steel anchors or ties spaced not more than 16 inches 400 millimeter on center vertically. Nonbearing walls or partitions abutting exterior walls shall be anchored thereto with metal anchors or ties spaced not more than 16 inches 400 millimeter on center vertically.

Masonry walls shall be isolated from the structural steel frame by means of asphalt-impregnated cellular-paper isolation liners. Ties and anchors shall be the flexible type to permit independent movement of each material.

Wall chases and recesses shall be plumb and smooth and shall have at least 8 inches 200 millimeter of masonry between the edge of chase and jamb openings.

Size of any two adjacent units shall be within permitted tolerances so that the difference between the vertical faces shall not exceed 1/8 inch 3.2 millimeter for block masonry or 1/16 inch 2.0 millimeter for brick masonry when used in exposed-to-view or painted walls.

Units in exposed-to-view locations or painted walls shall be free from chipped edges or other imperfections detracting from the appearance of the finished work.

Any masonry unit that is moved or disturbed after laying shall be removed, cleaned thoroughly, and relaid in fresh mortar.

Unfinished masonry work shall be racked or stepped back. Toothing will not be permitted without prior approval.

Units having 1-inch 25 millimeter minimum radius bullnose shall be provided throughout interior spaces at vertical external corners of interior block-masonry-unit walls and partitions that will be exposed to view or painted, except at door jambs, window jambs, and at external corners in attics, crawl spaces, and closets.

3.1.2 Height of Interior Partitions

NOTE: Drawings must indicate and fully detail areas where masonry walls extend full height to bottom of roof or floor above, areas where walls terminate above the ceiling, conditions where masonry walls terminate against the bottom flange of steel joists, and where full height partitions are not required for fire rating, acoustical separation, or structural support.

Interior masonry walls and partitions shall be carried to the full height of the story to the bottom of the floor above or roof deck, and the joint filled with mortar.

3.1.3 Built-In Work

Electrical piping and equipment, expansion strips, wall flashings, anchors, ties, wall plugs, reglets, flashing receivers, and accessories shall be built in as the masonry work progresses. Spaces around metal door frames shall be solidly filled with mortar. Built-ins shall be solidly bedded in mortar or grout.

3.1.4 Fire-Rated Walls and Partitions

Construction of fire-rated masonry walls shall be in accordance with [ICC

IPC] [ICC IBC].

3.1.5 Cold-Weather Provisions

Unless proper precautions are taken, masonry shall be erected only when the ambient temperature is at least 40 degrees F 5 degrees C and rising. Approved methods shall be provided to protect the work from freezing. Use of admixtures or antifreeze agents to lower the freezing point of mortars is prohibited.

Along with the following requirements, approved methods shall comply with the cold weather construction ACI 306R and ACI 530.1.

All materials, including brick, block and mortar ingredients shall be maintained at a minimum temperature of 40 degrees F 5 degrees C prior to and during erection, and for a period of 24 hours after erection of the masonry wall.

Temperature of materials shall be measured as required. Mortar ingredients shall be heated when required to produce mortar temperatures between 40 and 100 degrees F 4 and 38 degrees C. Sand shall be heated when required to 70 to 80 degrees F 21 to 27 degrees C. Water shall be heated when required to 90 to 100 degrees F 32 to 38 degrees C. Masonry units shall be kept dry, and heated when required to 40 to 50 degrees F 4 to 10 degrees C.

Protective enclosures and supplemental heat shall be provided when required to provide a minimum ambient air temperature of 40 degrees F 4 degrees C during erection and for a period of 24 hours after erection of the masonry wall.

3.1.6 Mortar

Mortar shall be mixed in accordance with ASTM C 270.

Hand mixing, when permitted, shall be performed in a tight mortar mixing box. Mixing time shall be not less than that required to reproduce results obtained by machine mixing after the required amount of water has been added.

Mortar shall be used and placed in final position within 1-1/2 hours after mixing. Mortar not used within the specified time limit shall be discarded.

3.1.7 Joints

Except for joints to be calked or raked, all exposed joints shall be tooled evenly to a dense concave profile, with surface and edges compacted and sealed. Tooling shall be performed after joints are "thumbprint" hard.

Exterior joints below grade shall be trowel pointed. Concealed joints and walls to receive plaster or plastic wall covering shall have flush mortar joints.

Joints to be tuck pointed shall be raked out to a depth of 1/2 inch 13 millimeter. Immediately before pointing, the joint shall be saturated with

clean water and filled solidly with mortar.

Joint thickness shall average 3/8 inch 10 millimeter or where required to match adjacent coursing in an existing structure. Joints shall have a minimum thickness of 1/4 inch 6 millimeter and a maximum thickness of 1/2 inch 13 millimeter. Where approved, joint thickness shall be gradually increased or decreased to meet indicated wall dimensions and to avoid cutting, squeezing, or opening of joints at ends of runs or lifts.

Exterior and interior joints between metal frames and masonry, wood frames and masonry, joints between mechanical equipment and masonry, and between other joints indicated shall be raked out to the required depth and left ready for sealant.

3.1.1.8 Control Joints

NOTE: Drawings must indicate joint location, spacing and construction. Particular attention must be given to joints in cavity walls and between composite materials. Expansion joints must be placed at offsets and junctions of walls, at or near corners in both cavity and solid masonry walls, at parapets, at junctions of masonry, enclosed steel, or concrete columns and pilasters.

A movement joint shall be provided through the outer wythe of a cavity wall on each side of an external corner when the wall extending into it is 50 feet 15.2 meter or more in length and at intersecting cavity wall junctions, pilasters, and concealed and exposed columns.

Expansion joints in brick masonry shall be complete with joint fillers and left ready for sealant.

Control joints in straight wall runs of block masonry shall be constructed by using standard stretcher units to provide a continuous unbroken vertical joint, 1/2-inch 13 millimeter wide, through the entire thickness of the wall. One side of the joint shall be lined with roofing felt and a flexible joint filler installed where indicated. Core space shall be completely filled with mortar and the joint raked clean and ready for sealant.

Control joints in block masonry at intersecting partitions, between block masonry and reinforced concrete, and between block masonry and brick masonry shall be constructed with sash block and flexible joint filler.

To secure freedom of movement at control joints, slip-planes of building paper or other approved material shall be placed in mortar joints between the portion of prefabricated or block masonry lintels required for bearing and supporting jamb sections that form a part of control joint and between the adjacent end face of such lintels and adjoining masonry units. Control jointing carried above such openings shall be located in the same vertical plane as the slip joint formed at the end of the lintel.

3.1.9 Weep Holes

Weep holes shall be provided at 24-inch 600 millimeter intervals. Holes shall be joint width and brick height.

Weep holes shall be provided at lintels, at flashed wall openings, at top of wall, and at foundations in cavity-wall construction.

Removable weep hole fillers shall be preformed sponge-rubber joint filler material, conforming to ASTM D 1752, Type I. Filler shall be full vertical joint height, 3/8-inch 10 millimeter thick, by 8-inches 200 millimeter long.

3.1.10 Flashing

NOTE: Through-wall flashing is not recommended in earthquake areas. When SMACNA ASMM is indicated, the respective plate number must be included.

Flashing shall be provided beneath copings, over wall openings, at spandrels, under sills, at building expansion joints, for termite barriers, and in locations where flashing is built into the masonry.

Flashing of wall openings and through-wall flashings shall conform to SMACNA ASMM. Flashing shall extend 4 inches 100 millimeter or more beyond edge of lintels and sills and turn up edge on sides and back to form pan and to direct moisture to exterior. Flashing shall terminate 1/2 inch 13 millimeter from the face of the wall.

Joints in concealed flashing shall be made by interlocking or laps. Lap joints shall be sealed with mastic. Spaces around dowels and openings in flashings shall be sealed with mastic before covering the flashing with mortar.

Building expansion-joint flashing shall be formed as shown in SMACNA ASMM. Unit lengths shall be not less than 8-foot 2438 millimeter sections and shall be continuous from top of wall to bottom of footing. Joints shall be lapped 4 inches 100 millimeter in the direction of water flow. Joints below grade shall be soldered or welded. A folded edge on each flange shall be provided and the flange shall be built 4 inches 100 millimeter into masonry.

Continuous concealed flashing shall be provided in cavity walls and at the bottom of the cavity.

3.1.11 Facing Brick

NOTE: Running bond and stack bond are specified. Revise these paragraphs if other special bonding is required.

Facing brick shall be laid in running bond, with the better face of the brick exposed. Face and ends, corners, and reveals shall be uniformly straight and true, free from chips and spalls, and uniform in color and texture.

Where indicated as stack-bond pattern, facing brick shall be selected for uniform size, color, and texture and shall be laid with plumb and uniform vertical joints.

Face brick shall be laid out and adjusted to each wall space. No course shall finish at external corners or at jambs with less than a full header. Header shall center on the stretcher or on the joints of adjoining courses.

Closers shall be avoided where possible. When necessary to maintain bond, closers shall be placed symmetrical with the center line of openings. No closer shall be less than 2-inches 50 millimeter wide.

Brick masonry units shall be wetted prior to laying. When being laid, units shall have sufficient suction to hold the mortar and to absorb excess moisture but shall leave mortar plastic and workable.

Bricks shall be laid with bed and vertical joints evenly and solidly filled with mortar. Mortar beds shall be spread smooth and the ends of the brick shall be buttered with sufficient mortar to completely fill the end joint when the brick is in place.

Vertical longitudinal joints in all exterior walls, except cavity walls, shall be completely filled by pargeting, either the face of the masonry backup, or back of the facing, or by pouring the vertical joint full of grout, or by shoving to obtain a wall entirely free from voids or open joints.

Interior face-brick walls shall be laid as specified, with full bed and vertical mortar joints; the vertical longitudinal joint between inner and outer wythes need not be pargeted or filled.

3.1.12 Building Brick

The following shall be constructed of building brick:

Walls not exposed to view and indicated as brick

Brick masonry backup walls and piers indicated as building brick

Exterior brick-wall facing below grade

Exterior or interior walls indicated as building or common brick

Building brick, when laid as an exterior wall facing below grade, with 8-inch 200 millimeter concrete masonry backup, shall be bonded to the backing every 16-inches 400 millimeter vertically with full brick headers. Block masonry walls shall be reinforced with continuous metal-tie

reinforcing.

A minimum of [_____] inches millimeter of solid masonry shall be laid in walls to receive lintels, metal joists, structural steel, or concrete beams in utility rooms and in rooms not exposed to public view.

Building brick shall not be exposed in finished rooms.

3.1.13 Installation of Joint Reinforcement

Joint reinforcement shall be installed in bed joints at 16-inch 400 millimeter vertical spacing starting at 16-inches 400 millimeter above the first course. Reinforcement shall also be in the first and second bed joints, 8-inches 200 millimeter apart, immediately above lintels and below sills of openings. Reinforcement in the second bed joint above and below openings shall extend 2-feet 600 millimeter beyond jambs. All other reinforcement shall be continuous except that it shall not pass through vertical masonry control or expansion joints. Side rods shall be lapped 6 inches 150 millimeter at splices. Reinforcement shall be placed to ensure a minimum of 5/8-inch 16 millimeter mortar cover on the exterior face of the wall and 1/2-inch 13 millimeter mortar cover on interior faces.

3.1.14 Installation of Masonry Anchors and Ties

3.1.14.1 Dovetail Slots, Anchors, and Ties

Dovetail slots shall be installed at a maximum spacing of 2 feet 600 millimeter on center.

Dovetail anchors and ties shall be installed at a maximum vertical spacing of 16 inches 400 millimeter on center.

3.1.14.2 Individual and Adjustable Wall Ties

Individual and adjustable wall ties shall be installed 24 inches 600 millimeter on horizontal center and 16 inches 400 millimeter on vertical center.

3.1.14.3 Column and Beam Anchors and Ties

Anchors shall be installed a maximum of 48 inches 1200 millimeter on center.

Column clips shall be installed 24 inches 600 millimeter on center.

3.1.15 Block Masonry

Block masonry units shall be handled carefully to protect edges and exposed surfaces from damage.

Block masonry units shall not be dampened or wet before laying or during the process of laying in the wall.

Block masonry units shall be laid in running bond except in walls where stack bond or special shapes are indicated. Walls, corners, and reveals

shall be laid plumb, true to line, and leveled in accurately spaced courses. Each course shall be bonded and interlocked at corners and intersections. Vertical joints shall be broken at 3 inches 75 millimeter, minimum.

Intersecting nonbearing block masonry walls shall be tied to other masonry walls by strips of galvanized metal lath or 1/4-inch 6.3 millimeter mesh galvanized hardware cloth placed across the joint between the two walls in alternate courses. When walls are exposed-to-view finished walls, a vertical control joint shall be constructed where the two walls meet. Control joint shall be raked out to a depth of 3/4 inch 19 millimeter and left ready for sealant.

Intersecting bearing walls shall not be tied together in masonry bond except at corners. One wall shall terminate at the face of the other wall with a control joint at that point. Walls shall be tied together with a steel tie bar, 1/4 by 1-1/4 by 28-inches 7 by 32 by 711 millimeter long, with 2-inch 50 millimeter bends at each end, spaced 32 inches 800 millimeter on vertical center. Bars shall be embedded at each end in mortar-filled cores. When walls are exposed at finished walls or walls subject to weather, the control joint shall be raked out to a depth of 3/4 inch 19 millimeter and left ready for sealant.

Block masonry units shall be laid in a full, mortar bed, full thickness of the face shell, except that full mortar bedding shall be provided under the first or starter course of units laid on footings and solid foundation walls and in all courses of piers, columns, and pilasters. Mortar shall be applied over the full thickness and height of the face shell to form the vertical mortar joint.

Horizontal and vertical joints of solid units and concrete building brick shall be filled solid. Mortar shall be spread over the full horizontal and end areas of the unit.

Joint thickness and tooling shall be as specified in paragraph entitled, "Joints."

Block masonry walls shall be reinforced with continuous wire joint reinforcement. Building brick, solid block masonry, or concrete brick shall be provided at the top of walls and under joists, beams, and concentrated loads, unless a bond beam or other structural member is indicated. Top course of block masonry units shall be filled with mortar or concrete. A layer of metal lath shall be used in the joint below to positively hold the mortar when rodded into the core space.

Where block masonry is the finished wall surface, bearing for metal joists, structural steel, or concrete shall be three courses of solid concrete brick or block masonry the same color and texture as adjacent block masonry.

3.1.16 Grout

Grout shall be thoroughly machine mixed for a period of at least 5 minutes after all materials are in a mixer designed for this purpose.

Cells shall be grouted solid in maximum 4-foot 1200 millimeter lifts. The pour shall be stopped 1-1/2 inches 40 millimeter below the top of the block. A cleanout shall be provided at the bottom of the cells where the placement of grout is in excess of 4 feet 1200 millimeter. Continuous unobstructed cell area of not less than 2 by 3 inches 50 by 75 millimeter shall be maintained. Anchors, bolts, inserts, etc., shall be solidly grouted in place. Where required, filling of cells that are to remain open shall be prevented by means of metal lath or a shield and by mortaring cross-webs where adjacent cells or cavities are to be grouted.

Grouting shall be performed in one continuous operation.

3.1.17 Bond Beams

Units filled with concrete of the indicated design shall be provided. Concrete fill shall have a minimum compressive strength of 3,000 psi 21 Megapascal at 28 days. Bond beam reinforcement shall be placed as necessary.

3.1.18 Cavity Walls

Inner and outer wythes of cavity walls shall be completely separated by a continuous air space not less than 2-inches 50 millimeter nor more than 4-inches 100 millimeter wide, except for masonry returns indicated at jambs of openings. Two wythes shall be securely tied together by continuous wire reinforcement spaced not to exceed 16-inches 400 millimeter apart vertically. Additional cavity wall ties shall be placed within 8 inches 200 millimeter of the jambs of all openings and not more than 2-feet 600 millimeter apart vertically except where the wythes are bonded together with masonry returns at jambs. Inner and outer wythes of cavity walls shall be provided with control joints and joint reinforcement. At control joints, the alignment of both wythes shall be maintained by ties 16 inches 400 millimeter on center vertically along each side of the control joint. Parge the outface of the block backing with mortar 3/8-inch 10 millimeter thick, troweled to a smooth, dense surface. Air space between the facing and backing wythes shall be kept clear and clean of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before the next row of ties or anchors is placed.

Weep holes shall be provided 24 inches 600 millimeter on center in mortar joints of the exterior wythe along the bottom of the cavity over foundations, bond beams, and other water stops in the wall, above grade line. Weep holes shall also be provided near the top of the cavity.

Weep holes and flashing for cavity walls shall be in accordance with paragraphs entitled, "Weep Holes" and "Flashing."

3.1.19 Cutting, Fitting, and Patching

Cutting and fitting masonry as required to meet building dimensions or to accommodate mechanical and electrical piping and equipment shall be performed by masonry mechanics.

Work shall be performed such that edges are unbroken and cut plumb and true.

Patching shall be performed such that original adjacent surfaces shall be matched in materials and workmanship.

3.1.20 Stone Coping and Sill Installations

Stone coping and sills shall be laid in full mortar bed with thru-wall flashing placed in the center of mortar bed.

Dowels shall attach ends of each coping unit.

Joints shall be "soft" with backer rod and sealant at each joint in coping.

Stone sill shall have solid mortar joints.

3.1.21 Chimneys

Chimneys shall be built of brick and lined with fire clay or other approved flue lining of the size indicated. Flue lining shall extend from 1-foot 300 millimeter below the smoke inlet to the full height of the chimney and 2 inches 50 millimeter or more above the chimney cap. Thimbles shall be placed as indicated or as directed. Spacing between the lining and the enclosing masonry shall be solidly filled with mortar. Linings shall be built in as the work progresses. Vertical joints of top course of brickwork of chimneys shall be raked out about 3/4-inch 19 millimeter deep to provide a key for the cement-mortar setting bed for the chimney cap or cement-mortar wash on top of brickwork. Chimney tops shall be provided with a wash-type cap, 1 inch 25 millimeter or more thick at its outer edge, composed of 1 part portland cement, 2 parts well-graded coarse sand and reinforced with 2 rings of (0.2294 AWG) 3-gage 5.6 millimeter or heavier galvanized steel wire having ends lapped 6 inches 150 millimeter.

3.1.22 Fireplaces

Fireplaces shall be faced with the same type of brick that is used for the facing of exposed exterior masonry walls. Backing construction of fireplaces shall have built-in metal ties 1 foot 305 millimeter on center in every other course to tie in the fireplace facing and lining.

Fireplaces shall be lined on the back and sides of the fire chamber with firebrick selected for uniformity of shape and color. Back hearth in the fire chamber shall also be of firebrick. Firebrick shall be laid with mortar joints not more than 1/4-inch 6.0 millimeter wide. Hearth brick shall be of a reasonably smooth surface of approximately the same color as the fireplace facing and shall be laid on a full bed of mortar, with flush joints in the pattern indicated. Metal damper, angle lintel, and ash dump shall be built into the adjoining brickwork with spaces between the metal items and brickwork filled solid with mortar.

3.1.23 Structural Clay Tile

Structural clay tile, before being laid, shall be wetted so as to have an initial rate of absorption of not more than 12 percent when determined in accordance with ASTM C 67.

3.1.24 Lintels

Lintels for openings 22-inches 560 millimeter wide or less shall be formed of single whole tile. Lintels for openings over 22-inches 560 millimeter wide shall be precast with top and bottom cores filled solid with gypsum mortar reinforced full length with not less than one continuous 1/2-inch 13 millimeter rod. Precast lintels shall remain undisturbed for at least 72 hours after being formed and shall be extended not less than 8 inches 200 millimeter in length at each end. Lintels shall be set in full bed of mortar and blocked up as necessary to provide a full 1/2-inch 13 millimeter clearance above top of frames.

3.2 INSULATING OF EXTERIOR MASONRY WALLS

3.2.1 Insulation

Exterior cavity walls shall be insulated by [completely filling the airspace between the wythes] [completely filling the cells of the inner wythe with water-repellent loose fill masonry insulation or by installing rigid board-type insulation in the airspace against the inner wythe].

Exterior single-wythe block-masonry-unit walls shall be insulated by completely filling the cells of the units with water-repellent loose-fill insulation.

Insulation shall be completely brought up to the elevations indicated for the underside of door and window sills, bond beams, lintels, through-wall flashing, and similar interruptions through the cavity before installing these items.

3.2.2 Loose-Fill Insulation

Loose-fill insulation shall be brought up alternately with the masonry with not more than a 4-foot 1200 millimeter high section of wall completed before insulation is poured in the airspace between the wythes. Not more than a 2-foot 600 millimeter high section of wall shall be completed before insulation is poured in the cells of block masonry units. Insulation shall be poured from the top of each height of wall section completed and allowed to assume its natural density. Loose-fill insulation shall not be tamped.

3.2.3 Rigid-Board Insulation

Rigid-board insulation shall be applied directly to the masonry with adhesive. Impaling of insulation on cavity-wall ties or anchors will not be permitted. Insulation shall be applied in parallel courses with joints breaking midway over the course below, shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.2.4 Foam Insulation

Foam insulation shall be gun-applied to areas indicated by an applicator approved by the manufacturer and in strict accordance with the manufacturer's printed instructions.

3.3 POINTING AND CLEANING

Masonry walls shall be dry brushed at the end of each day's work.

Upon completion of the work, holes and defects in exposed mortar joints shall be raked as required, filled with fresh mortar, and tooled.

After mortar is set and cured, mortar particles shall be removed with wood paddles, brushes, and scrapers before wetting the wall.

Brick masonry walls shall be cleaned in accordance with BIA Tech Note 20.

Detergent cleaning compound shall be type formulated to reduce metallic stains. Cleaning compounds shall be used in accordance with the manufacturer's instructions.

Glazed brick limestone units and prefaced masonry units shall be carefully wiped clean with a soft cloth immediately after laying. At completion of work, surfaces shall be given a final cleaning with water and a cleaning compound applied with a soft sponge or brush as recommended by the manufacturer.

Block masonry shall be cleaned with stiff brushes and clear water. Acid shall not be used in the cleaning process. Joints shall be rubbed with a carborundum stone to remove burrs and rough edges.

Sandblasting techniques for cleaning will be permitted only when approved.

3.4 GLASS BLOCK INSTALLATION

Glass-block panel reinforcement shall be embedded in horizontal mortar joints 24 inches 600 millimeter on center and in joints above and below openings within the panels. Reinforcing shall run continuously from end to end of panels and shall be lapped 6 inches 150 millimeter where more than one length is used. Expansion joints shall not be bridged with panel reinforcing.

Panel anchors shall be installed in accordance with the glass-block manufacturer's recommendations.

Glass block shall be installed in accordance with the manufacturer's written directions, complete with joints filled and ready to receive sealant at jambs and head.

3.5 ADDITIONS TO EXISTING STRUCTURES

NOTE: When additions to existing structures are required, drawings must indicate coursing in new and existing structures, plan location of expansion joints, and points of connection, new openings, and special conditions.

3.5.1 Matching Existing Work

New masonry work shall match existing in coursing, bonding, color, and texture.

3.5.2 Connections with Existing Structures

[New masonry work shall be "toothed" into the existing masonry work.]

[New masonry work shall be separated from existing masonry work by expansion joints.]

3.5.3 Cutting and Patching

Cutting existing masonry work shall be performed with masonry saws and in a manner that will ensure unbroken edges cut plumb and true.

Patching of existing masonry work, after the installation of new masonry work, shall match the quality and the material of existing adjacent surfaces.

-- End of Section --